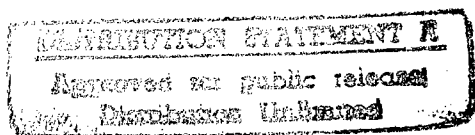


Basewide Energy Systems Plan

**Executive Summary
Final Report**

Fort Gordon, Georgia



January 1983

DISQUALIFIED

Prepared For
MOBILE DISTRICT CORPS OF ENGINEERS
MOBILE, ALABAMA
CONTRACT DACA01-77-C-0094

19971017 243

Prepared By
BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

EXECUTIVE SUMMARY

This is a summary of the results for Increments A, B, C, D, and E of the Basewide Energy Systems Plan for Fort Gordon, Georgia. (The results for Increments F and G are summarized on pages 5 through 7.) The plan includes analyses and recommendations of energy conservation projects for reduction of the installation's present energy consumption. The installation should be aware that savings figures presented in this summary can only be realized after all projects have been implemented. Black & Veatch has developed projects that would meet the funding requirements for the energy conservation program. Furthermore, the recommended projects provide partial compliance with the energy conservation requirements for the installation as outlined in the Army Facilities Energy Plan. This summary presents data on the following:

- Existing energy consumption
- Source energy reductions due to energy conservation techniques for buildings and their systems
- Application of solar energy to reduce fossil fuel consumption
- Savings utilizing central energy monitoring and control systems (EMCS)
- Use of solid waste as an alternate energy source
- Analysis of Total Energy/Selective Energy (TE/SE) systems

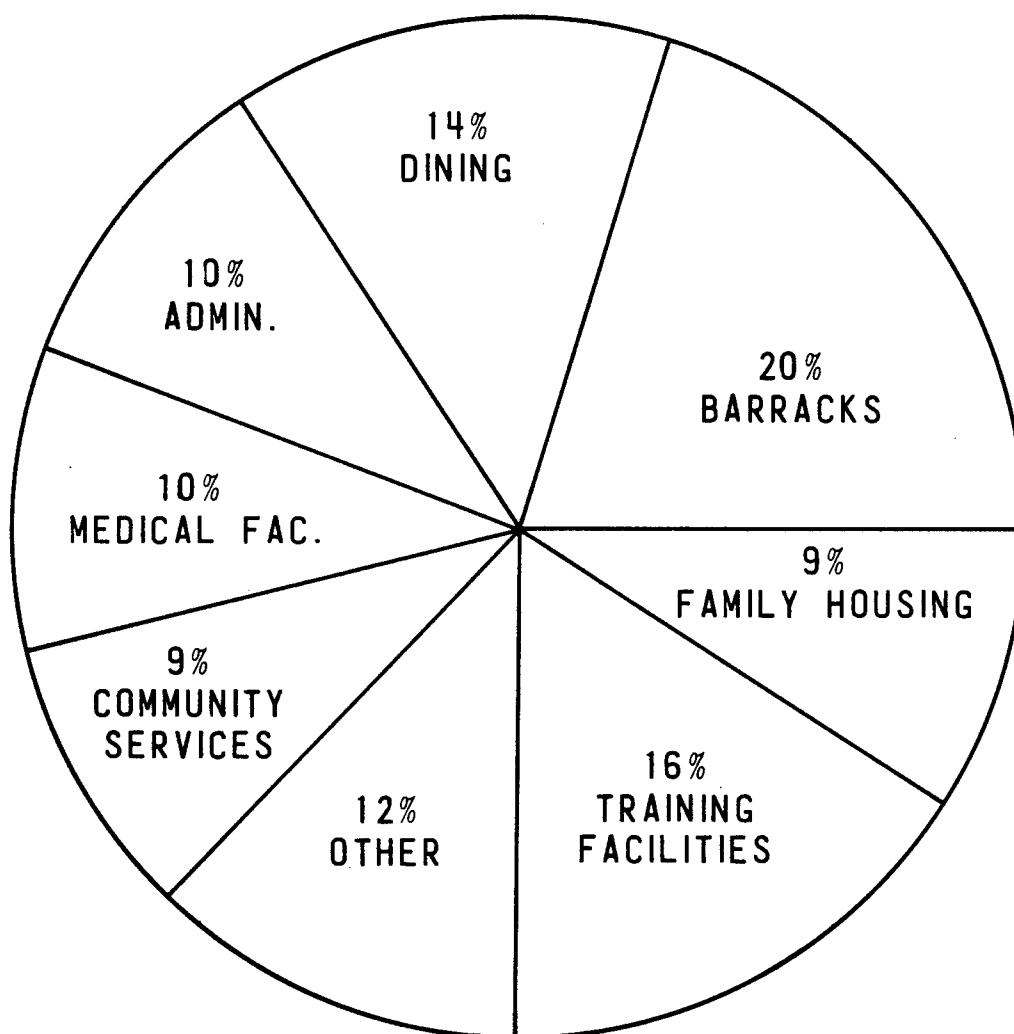
Tables 1 and 2 present information pertaining to the physical descriptions and energy consumption of 48 typical buildings used to verify historical energy consumption in the development of the basewide energy use model. This model was then utilized as the foundation for energy conservation project analyses and recommendations. Table 3 summarizes the daily personnel occupancy for each typical building. Tables 1, 2 and 3 also provide information which may be used to estimate source energy consumption for similar buildings within the designated groupings (see Appendix A for all tables referenced in this report). The estimated annual source energy consumption for all building types contributing to the basewide annual total of 2,547,806 mega-Btu, consumed during base year 1975, is shown on Figure 1.

Table 4 indicates the annual source energy consumed by each of the significant building groups used in our basewide energy mode. The model was within 10 percent of the historical source energy consumption for FY 1978 shown below.

Yearly Source Energy
Consumption in Btu x 10⁶

1978

Electricity	1,089,310
Natural Gas	972,155
Propane Gas	85,858
Fuel Oil No. 2	419,154
Kerosene	<u>14,340</u>
TOTAL	2,580,817



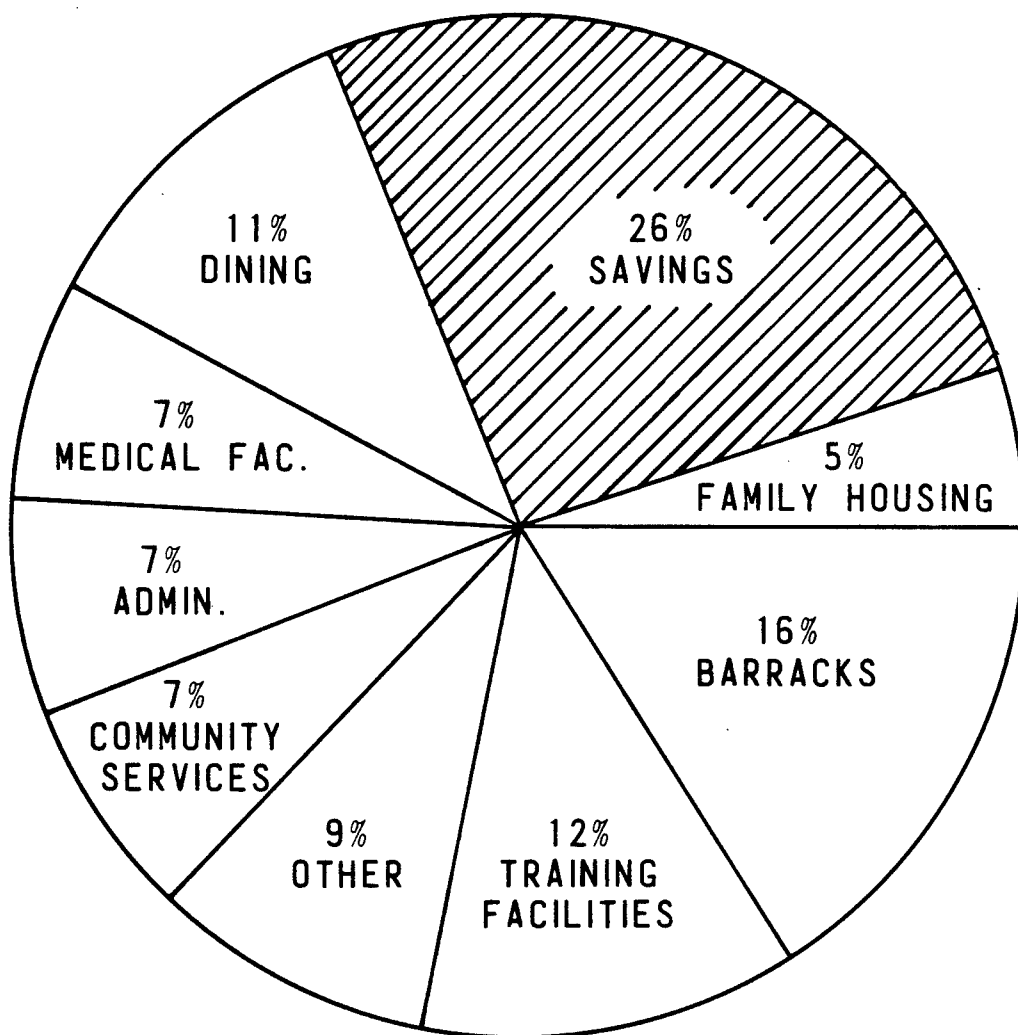
BASEWIDE CONSUMPTION FY'75

FIGURE 1

The total estimated source energy savings due to implementation of all feasible energy conservation projects developed within the scope of Increments A, B, C, D, and E of this study is 664,732 mega-Btu/year. These projects consisted of various architectural improvements, and mechanical and electrical system modifications.

Table 5 lists the project number, percent of basewide reduction, and the source energy savings for the indicated building types. Figure 2 illustrates the combined effect of the recommended energy saving improvements, as compared to the FY 1975 source energy expenditure. Our estimates indicate a savings of approximately 26 percent over the base year (1975). Figure 3 illustrates the relative percent reduction for significant building group comprising the 664,732 mega-Btu/year.

A detailed analysis of the projects listed in Table 5 is included in the following reports. Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis can be found in the Energy Use Survey. The reduction of Fort Gordon's dependence on nonrenewable energy sources by utilizing solar energy, a renewable energy source, indicates a total savings of 15,082 mega-Btu/year. Seven concepts were evaluated, which resulted in the Department of Energy selecting the roof-mounted solar ponds for the production of domestic hot water for barracks as a demonstration project. The seven concepts studied are presented in the Solar Energy Applications and Evaluations. The Energy Monitoring and Control Systems (EMCS) study includes recommendations for an extension of the existing system, and the utilization of an FM control system. An extension of



BASEWIDE CONSUMPTION AFTER ENERGY
CONSERVATION PROJECTS

FIGURE 2

ALLOCATION OF ENERGY CONSERVATION
PROJECTS SAVINGS

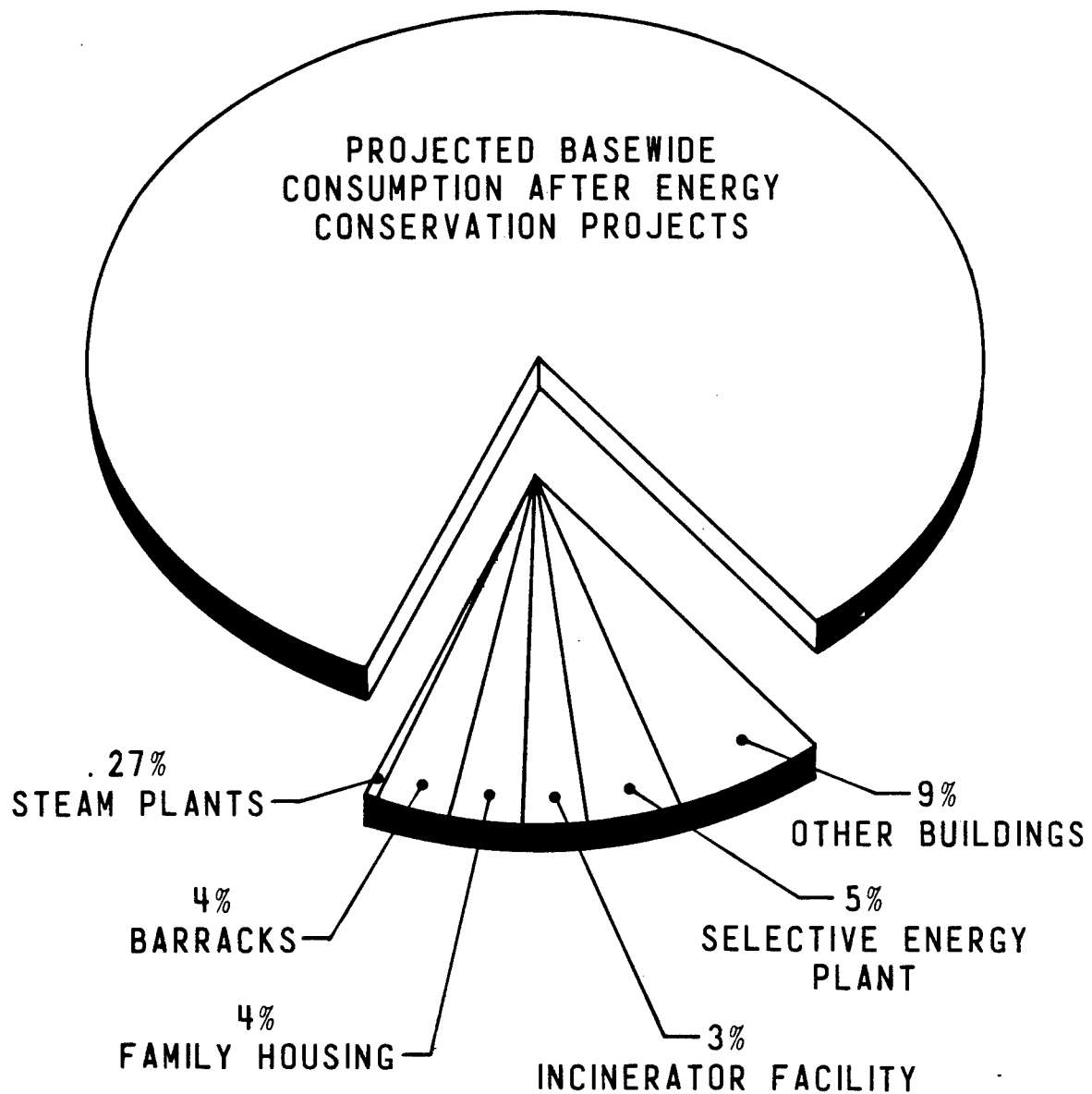


FIGURE 3

the existing system would result in a savings of 63,330 mega-Btu/year, while the FM control system would save 45,803 mega-Btu/year. The investigation of solid waste for reducing source energy consumption at Fort Gordon resulted in the development of Project No. 166, which recommends the installation of a solid waste-burning incinerator facility to provide steam to the existing steam distribution system. The proposed plant, to be located adjacent to existing Boiler Plant No. 25910, would provide reduction in both fuel oil and electric consumption totalling 108,150 mega-Btu/year. The details and descriptions of the systems analyzed can be found in the report entitled Total Energy, Selective Energy, and Central Boiler Plants.

The incorporation of a total energy system at this installation would not be recommended. However, a selective energy plant utilizing coal-fired boilers would reduce the basewide consumption of fuel oil and natural gas by 57 percent. This plant would be capable of generating 27 percent of the required electrical power at Fort Gordon. A 5 percent reduction in the basewide annual source energy consumption can be expected. Detailed descriptions of the TE/SE systems analyzed are included in the Total Energy, Selective Energy, and Central Boiler Plants report.

Table 6 was developed to give a prioritized schedule, in order of fiscal year, for implementing the recommended energy conservation projects.

EXECUTIVE SUMMARY-INCREMENTS F AND G

Increment F - Facilities Engineer Conservation Measures.
Increment G - Maintenance, Repair, and Minor Construction
Projects.

This is a summary of the two phases of work that were started after the completion of Increments A, B, C, D, and E in May of 1980. Increments F and G were completed in November, 1982.

The purpose of Increment F of the Basewide Energy Systems Plan is to identify and develop recommendations that can be used by Fort Gordon in preparing its energy management plan. Included are a number of comparatively low cost projects, recommendations for training, and prioritized lists of possible energy conservation measures. Increment G identified maintenance, repair, and minor construction projects for the purpose of conserving energy. These are energy conservation projects that did not meet ECIP criteria or did not fit the ECIP program at the time that the remainder of the study was completed.

The average costs of energy for FY 1981 are given in Table 7. These costs have been used as the basis for determining the dollar savings per year.

Recommended projects developed within the scope of Increments F and G of the study are summarized in Tables 8 and 9 respectively. Projects are prioritized by their E/C ratio. The E/C ratio is defined as the ratio of yearly energy savings in million Btu to the cost estimate in thousands of dollars. Any project showing a payback of 15 years or less is recommended. Cost estimates are representative of April, 1981 prices.

At the request of Fort Gordon, five 1391's were prepared from projects developed under Increments F and G. These are:

- ✓ ● High Temperature Water System Upgrade *86*
- Hospital Area
 - EMCS Extension
 - Reduce Fluorescent Lighting *In hand*
 - Power Factor Improvement
 - Consolidation of Substations
 - Air to Air Heat Recovery
- Family Housing
 - Outlet and Switch Insulation
 - Reduce Infiltration
 - Toilet Tank Dams
- ✓ ● Heating and Cooling *86*
 - Automatic Chiller Condenser Tube Cleaning
 - Destratifiers
 - Variable Speed Pumping
 - Heat Recovery from Dust Collector
 - Boiler Fuel Conservation/Oxygen Trim Controls
- Facility Energy Improvements
 - Fluorescent Lighting Load Reduction
 - Insulating Solar Film
 - Window Insulating Panels
 - Flow Control Shower Heads
 - Indoor Pool Lighting Upgrade - Metal Halide

2 RIP

Figure 4 is a pie chart showing projected future energy savings due to ECIP projects developed under Increments A, B, C, D, and E and projects developed under Increments F and G.

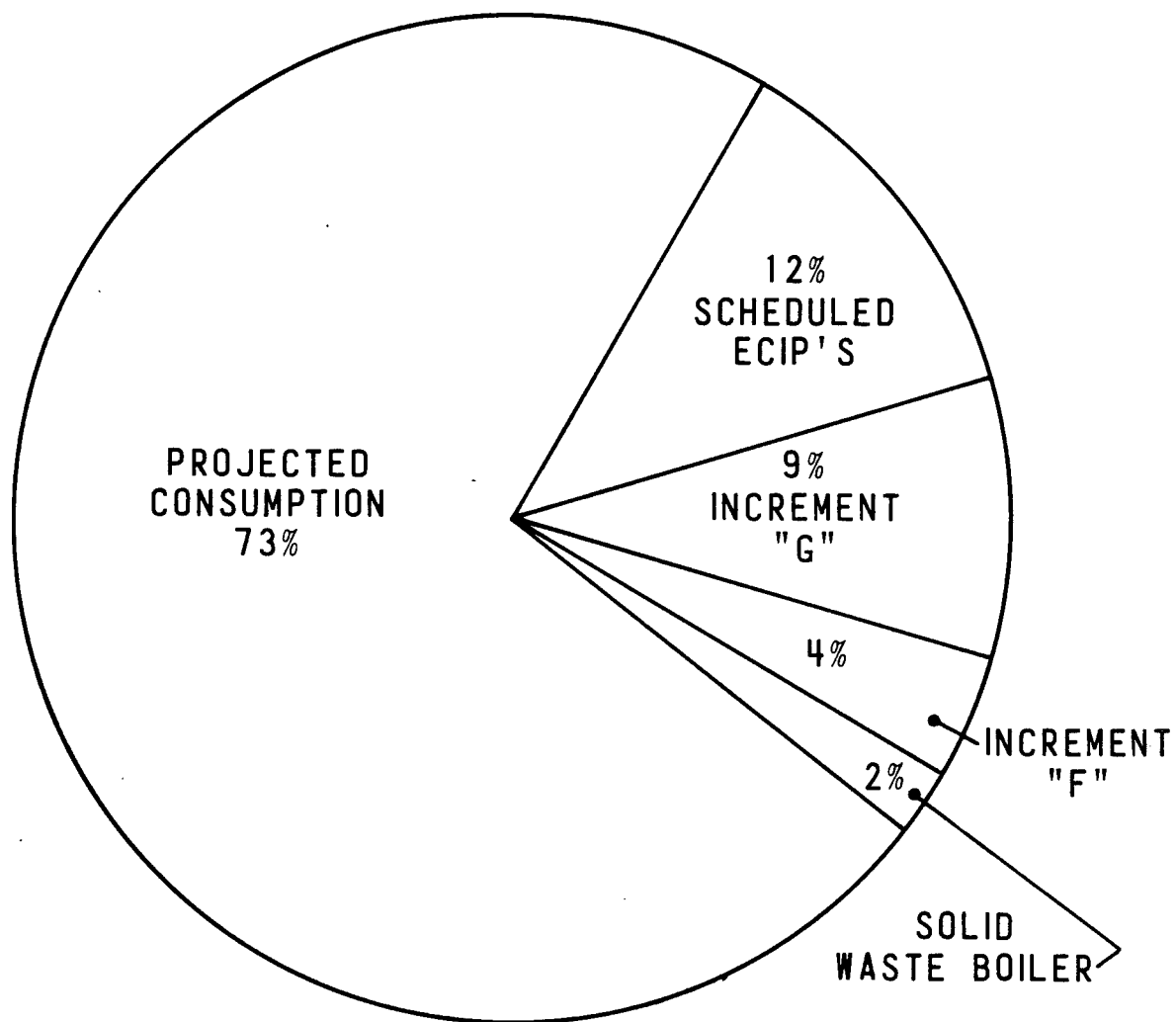
Figure 5 represents a forecast of Fort Gordon's future energy costs. The figure shows how costs could escalate if no energy conservation projects are implemented and what also could happen if all cost effective projects are implemented. The energy conservation projects would more than likely be implemented in three phases:

Phase I - ECIP.

Phase II - Increments F and G and Solid Waste Plant.

Phase III - Selective Energy Plant that would burn coal to
produce all the steam requirements and part of
the electrical requirements at Fort Gordon.

The curve shows a modest increase in FY87 due to new buildings. The large decrease shown in FY89 is primarily due to using coal, a cheaper fuel, in the Selective Energy Plant.



FORT GORDON
BASEWIDE CONSUMPTION FY'81
(2,671,215 MBTU)

FIGURE 4

EFFECT OF ESCALATION AND ENERGY CONSERVATION ON FUEL COST

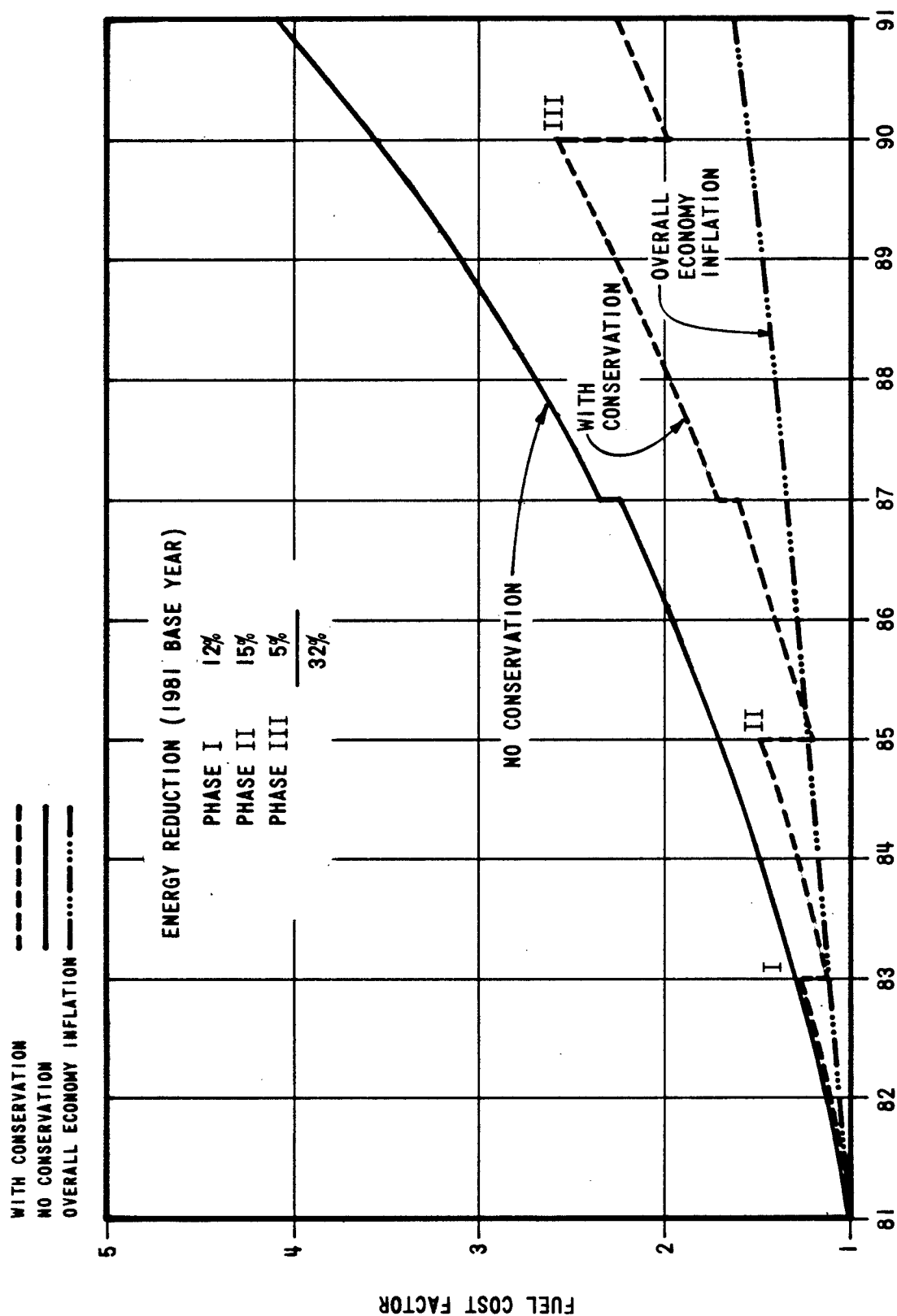


FIGURE 5

APPENDIX A

TABLES

TABLE I
TYPICAL BUILDING CONSTRUCTION DATA
FORT GORDON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NO. FLS.	CONSTRUCTION						"U" VALUES				WINDOW SQ. FT.	AREA (FT. 2)	COOLING		HEATING		PEAK TRNS LOAD MBH		DOMESTIC HOT WATER CAP. (G)
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR			SYSTEM	CAP. (TONS)	SYSTEM	FUEL	GAIN	LOSS	
A-1	29706	ADMINISTRATION	1	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.18	.29	-	1.13	.85	1221	12136	CENTRAL PLANT	15	B.P. 25910 HTV	HTV	46.9	220.0	75 GAS
A-2	18801	HEADQUARTERS BUILDING	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.24	.54	1.06	.47	330	2760	PACKAGE UNIT	10	BOILER	OIL	45.1	119.9	30 ELEC
A-3	39007	HEADQUARTERS BUILDING	1	COMPOSITE SHINGLE	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.51	-	1.13	.49	320	3040	NONE	-	FURNACE	GAS	-	97.9	NONE
A-4	19719	SUPPLY & ADMINISTRATION	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID WORE	.26	.23	.53	1.13	.49	310	2488	NONE	-	UNIT HEATER	GAS	-	82.0	80 GAS
A-5	29808	SIGNAL TOWER	11	BUILT-UP	BRICK & BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.09	.10	-	1.13	.55	16071	100783	CENTRAL PLANT	330	B.P. 25910 HTV	HTV	453.4	1218.2	150 GAS
B-1	39113	BARRACKS	1	METAL & BUILT-UP	CONC. BLOCK & METAL	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.06	.5	-	1.13	.55	544	6419	NONE	-	BOILER	GAS	-	126.7	75 GAS
B-2	36700	BARRACKS	8	BUILT-UP	BRICK	CONCRETE, BASEMENT	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.10	.39	.54	1.13	.55	13869	149883	CHILLER	350	BOILER	GAS	928.4	2897.0	2000 GAS
B-3	31601	BARRACKS	2	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.32	.24	.54	1.13	.49	511	5310	NONE	-	FURNACE	GAS	-	181.4	86 GAS
B-4	25718	BARRACKS	3	BUILT-UP	BRICK & BLOCK	TILE, VENTED CRAWL SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.04	.29	.52	1.13	.55	4868	41501	CENTRAL PLANT	294	B.P. 25910 HTV	HTV	229.0	730.4	75 GAS
B-5	18701	BARRACKS	2	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.36	.54	1.13	.49	500	5310	NONE	-	BOILER	OIL	-	128.1	85 GAS
CS-1	30504	CHAPEL	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TAG. ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.34	.26	.19	1.13	.49	500	3502	WINDOM & CENTRAL	20	BOILER	GAS	42.0	120.6	30 ELEC
CS-3	36201	LAUNDROMAT	1	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.05	.55	-	1.13	.55	462	4109	PACKAGE UNIT	40	FURNACES	GAS	38.9	111.0	70 GAS
CS-4	45402	DAY CARE CENTER	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.04	.24	.53	1.13	.49	360	4352	COND. UNIT	11	FURNACE	GAS	33.6	99.1	50 GAS
CS-5	44503	YOUTH ACTIVITIES KARATE CLASS	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.26	.23	.53	1.13	.49	285	3404	NONE	-	BOILER	OIL	-	163.8	30 ELEC
CS-6	33500	LIBRARY	1	BUILT-UP	BLOCK & STONE	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.06	.12	-	1.13	.55	771	14712	CHILLER	60	BOILER	OIL	59.3	207.3	50 GAS
CS-7	34407	TRAINING BUILDING	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.06	.25	.38	1.13	.49	228	3265	COND. UNIT	10	DUCT FURNACES	PROP. GAS	43.4	114.8	30 ELEC
CS-8	39005	POST EXCHANGE & WEIGHT ROOM	1	BUILT-UP	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.06	.5	.24	1.13	.55	132	3209	THRU WALL	3	FURNACE	GAS	4.9	102.6	50 GAS
CS-9	33417	LIBRARY	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.26	.23	.53	1.13	.49	281	2400	NONE	-	FURNACE	GAS	-	59.3	NONE
CS-10	40504	THEATER	1	BUILT-UP	CLAPBOARD ON WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.2	.3	-	1.13	.49	40	13330	CHILLERS	83	BOILER	GAS	87.6	294.4	NONE
D-1	29722	MESS HALL	1	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.04	.25	-	1.13	.55	1521	13773	CENTRAL PLANT	50	B.P. 25910 HTV	HTV	45.2	151.2	1000 HTV
D-2	39105	MESS HALL	1	COMPOSITE SHINGLE	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.11	.52	-	1.13	.49	221	4936	NONE	-	BOILER	OIL	-	144.0	80 GAS
D-3	39408	MESS HALL	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.05	.32	.46	1.13	.49	566	4050	NONE	-	UNIT HEATERS	GAS	-	104.5	80 GAS
FN-2	609	FAMILY HOUSING	1	COMPOSITE SHINGLE	BRICK & WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.08	.08	-	1.13	.49	281	1950	CENTRAL	4	FURNACE	GAS	11.1	40.3	40 GAS
FN-3	750	FAMILY HOUSING	2	COMPOSITE SHINGLE	WOOD SHEATHING	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.09	-	1.13	.49	448	3390	CENTRAL	5	FURNACES	GAS	16.6	54.8	80 GAS
FN-4	1973	FAMILY HOUSING	1	COMPOSITE SHINGLE	WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.08	-	1.13	.49	316	2864	CENTRAL	4	FURNACES	GAS	12.3	43.9	50 GAS
FN-5	2001	FAMILY HOUSING	1	COMPOSITE SHINGLE	WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.06	-	1.13	.49	306	2627	CENTRAL	4	FURNACE	GAS	11.1	44.2	50 GAS

TABLE 1 (CONT'D)

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NO. FLS.	CONSTRUCTION					"U" VALUES						WINDOW SQ. FT.	AREA (FT. ²)	COOLING		HEATING		PEAK TONS LOAD MHK	DOMESTIC HOT WATER CAP. (G)	
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	SYSTEM			CAP. (TONS)	SYSTEM	FUEL	LOSS			
FR-6	1602	FAMILY HOUSING	2	COMPOSITE SHINGLE	WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.08	-	1.13 1.06	.49 .47	668	5378	CENTRAL	7	FURNACE	GAS	37.1	86.9	80	GAS
LA-1	39706	SUPPLY	1	COMPOSITE SHINGLE	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.13	-	1.13 1.06	.49 .47	492	3200	THRU WALL	11	FURNACE	OIL	18.4	57.9	30	ELEC
L-1	2200	LAUNDRY	1	BUILT-UP	CLAPBOARD ON WOOD FRAME	CONC., ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.45	.21	.59	1.13 1.06	.49 .47	1760	56380	WINDOW UNITS	4	B.P. 2202	STEAM	9.5	820.9	N/A	STEAM
MA-1	21805	MAINTENANCE SHOP	1	BUILT-UP	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.43	.51	-	1.13 1.06	.55	150	4787	NONE	-	WATER HEATER	GAS	-	139.0	40	GAS
MA-2	24804	MAINTENANCE SHOP	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.44	.27	-	1.13 1.06	.49 .47	135	3108	NONE	-	BOILER	OIL	-	91.0	NONE	-
M-1	29605	MEDICAL CLINIC	1	BUILT-UP	CONC. & BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.07	.31 .35	-	1.13 1.06	.55	425	4060	CENTRAL PLANT	10	B.P. 25910	NH	34.3	101.3	60	GAS
M-3	300	HOSPITAL	13	BUILT-UP	PRECAST CONC.	TILE, BASEMENT	SINGLE TINTED GLASS	METAL	.07	.15	.05	1.13 1.06	.55	9970	623538	CENTRAL PLANT	1450	B.P. 301	NH	392.7	2704.7	500	STEAM
T-1	18717	TRAINING	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	VINYL, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.26	.36	.54	1.13 1.06	.49 .47	180	3000	CHILLER	10	BOILER	OIL	58.7	153.9	40	ELEC
T-2	25601	TRAINING	1	BUILT-UP	BRICK & PANEL	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.07	.3	-	1.13 1.06	.49 .47	288	5824	CENTRAL PLANT	25	B.P. 28910	NH	63.2	192.4	40	ELEC
T-3	38702	HCO SCHOOL	1	COMPOSITE SHINGLE	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.06	.44	-	1.13 1.06	.49 .47	300	1773	NONE	-	FURNACE	LPG GAS	-	50.3	90	ELEC
T-4	19724	TRAINING BLDG.	2	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.05	.32	.38	1.13 1.06	.49 .47	200	5310	NONE	-	BOILER	OIL	-	155.0	129	OIL
T-5	29809	SIGNAL SCHOOL	2	BUILT-UP	BRICK & CONC. BLOCK	CONCRETE CRAWL SPACE	SINGLE CLEAR GLASS	METAL	.08	.29	.53	1.13 1.06	.55	5351	72894	CENTRAL PLANT	185	B.P. 25910	NH	310.9	967.8	60	STEAM
T-6	25810	CLASSROOM	2	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.10	.34	-	1.13 1.06	.55	1838	187695	CENTRAL PLANT	155	B.P. 25910	NH	610.5	1608.6	130	NH
U-1	ALL SEWAGE OF TREATMENT GROUP																						
U-2	200	WATER TREATMENT																					
U-3	ALL BLDGS. IN THE GROUP																						
U-4	25910	BOILER PLANT	1	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD	.08	.44	-	1.13 1.06	.49 .47	44	14946	PACKAGE UNIT	3	WATER HEATER	NH	10.8	31.4	30	GAS
W-1	2212	COLD STORAGE WAREHOUSE	1	BUILT-UP	BRICK & CONC. BLOCK	CONC. ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	METAL	.046	.039	.53	1.13 1.06	.55	360	24668	CHILLER PKG. UNIT	195	BOILER	GAS	111.2	30.6	40	ELEC
W-2	42301	WAREHOUSE	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	TILE, ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.52	.36	.52	1.13 1.06	.49 .47	310	2700	NONE	-	FURNACE	OIL	-	112.2	NONE	-
W-3	2303	FURNITURE WAREHOUSE	1	COMPOSITE SHINGLE	CLAPBOARD ON WOOD FRAME	WOOD, ENCL. CRAWL SPACE	SINGLE CLEAR GLASS	WOOD	.44	.36	.53	1.13 1.06	.49 .47	20	9000	NONE	-	BOILER	OIL	-	196.3	30	ELEC
X		NO UTILITIES																					
Z		ELECTRIC ONLY (INCLUDES ELECTRIC AUXILIARIES & OUTDOOR LIGHTING)																					
														</									

TABLE 2
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT GORDON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTU x 10 ⁶			ELEC'L ENER. CONSUMPTION		BTU x 10 ³ FT ²
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
A-1	29706	ADMINISTRATION	1382	478	1861	11	41170	153.4
A-2	18801	HEADQUARTERS BUILDING	568	417	985	8	36010	358.2
A-3	39007	HEADQUARTERS BUILDING	442	219	661	6	18840	217.4
A-4	19719	SUPPLY & ADMINISTRATION	472	188	660	5	16240	265.3
A-5	29808	SIGNAL TOWER	22195	26506	48701	1000	2285000	483.2
B-1	39113	BARRACKS	903	253	1156	7	21830	180.1
B-2	36700	BARRACKS	13646	19705	33351	795	1698700	222.5
B-3	31601	BARRACKS	1323	168	1491	4	14490	280.8
B-4	25718	BARRACKS	8527	1998	10255	30	17220	247.1
B-5	18701	BARRACKS	721	166	887	4	14280	167.0
CS-1	30504	CHAPEL	258	1238	1496	58	106840	453.1
CS-3	35201	LAUNDROMAT	658	3268	3926	132	281710	956.9
CS-4	45402	DAY CARE CENTER	470	758	1228	50	65310	282.2
CS-5	44503	YOUTH ACTIVITIES KARATE CLASS	593	58	651	5	4970	191.2
CS-6	33500	LIBRARY	949	5463	6412	168	470980	435.8
CS-7	34407	TRAINING BUILDING	532	487	1019	26	42010	312.1
CS-8	39005	POST EXCHANGE & WEIGHT ROOM	453	243	696	22	20960	216.9
CS-9	33417	LIBRARY	381	188	569	5	16240	237.1
CS-10	40504	THEATER	1505	1844	3349	132	15900	251.2
D-1	29722	MESS HALL	14234	6877	21111	105	592806	1590.5
D-2	39105	MESS HALL	3045	3549	6594	59	305940	1335.9
D-3	39408	MESS HALL	883	242	1125	6	20820	277.8
FH-2	609	FAMILY HOUSING	256	218	474	9	18760	243.1
FH-3	750	FAMILY HOUSING	382	365	747	11	31480	220.4
FH-4	1973	FAMILY HOUSING	305	271	576	8	23390	233.8
FH-5	2001	FAMILY HOUSING	247	284	531	10	24540	202.1

TABLE 2 (CONT'D)
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT GORDON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTUx10 ⁶			ELEC'L ENER. CONSUMPTION		BTU x 10 ³ FT ²
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
FH-6	1602	FAMILY HOUSING	560	523	1083	17	45090	201.4
LA-1	39706	SUPPLY	295	434	729	19	37390	227.8
L-1	2200	LAUNDRY	23761	1401	25362	85	120800	449.8
MA-1	21805	MAINTENANCE SHOP	319	350	669	7	30150	139.8
MA-2	24804	MAINTENANCE SHOP	314	117	431	4	10120	138.7
M-1	29605	MEDICAL CLINIC	790	240	1030	57	20690	253.7
M-3	300	HOSPITAL	160870	102984	263854	1630	8877890	423.2
T-1	18717	TRAINING	476	761	1237	46	65570	412.3
T-2	25601	TRAINING	904	998	1902	55	86050	326.6
T-3	38702	NCO SCHOOL	125	147	272	8	12680	153.4
T-4	19724	TRAINING BLDG.	862	338	1200	13	29140	226.0
T-5	29809	SIGNAL SCHOOL	10546	8391	18937	253	723400	259.8
T-6	25810	CLASSROOM	47679	15541	63220	384	1339770	428.0
U-1	ALL OF GROUP	SEWAGE TREATMENT	0	2134	2134	21	183960	N/A
U-2	200	WATER TREATMENT	1044	43843	44887	431	3779580	4425.4
U-3		ALL BLDGS. IN THE GROUP	0	14700	14700	145	1267500	N/A
U-4	25910	BOILER PLANT	44	5071	5115	52	437190	342.2
W-1	2212	COLD STORAGE WAREHOUSE	380	3433	3813	90	295980	154.6
W-2	42301	WAREHOUSE	289	32	321	1	2740	118.9
W-3	2303	FURNITURE WAREHOUSE	640	87	727	3	7500	80.8
X		NO UTILITIES	← N/A →					
Z		ELECTRIC ONLY	0	116145	116145	N/A	8320243	N/A

TABLE 3
BUILDING OCCUPANCY
FORT GORDON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NORMAL PEAK POPULATION	OCCUPANCY
A-1	29706	ADMINISTRATION	100	WEEKDAYS - 7:00 A.M. TO 4:30 P.M.
A-2	18801	HEADQUARTERS BUILDING	9	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
A-3	99007	HEADQUARTERS BUILDING	20	WEEKDAYS - 7:00 A.M. TO 6:00 P.M. SATURDAY - 6:00 A.M. TO 1:00 P.M.
A-4	19715	SUPPLY AND ADMINISTRATION	25	WEEKDAYS - 7:00 A.M. TO 5:20 P.M.
B-1	39113	BARRACKS	53	OPEN 24 HOURS
B-2	36700	BARRACKS	299	OPEN 24 HOURS
B-3	91603	BARRACKS	50	OPEN 24 HOURS
B-4	25718	BARRACKS	258	OPEN 24 HOURS
B-5	18701	BARRACKS	74	OPEN 24 HOURS
CS-1	30504	CHAPEL	200	WEEKDAYS - 7:00 A.M. TO 8:00 A.M. SUNDAY - 8:00 A.M. TO 12:30 P.M.
CS-3	35201	LAUNDROMAT	9	WEEKDAYS - 9:00 A.M. TO 6:00 P.M. SATURDAY - 1:00 P.M. TO 5:00 P.M.
CS-4	45402	DAY CARE CENTER	25	WEEKDAYS - 7:30 A.M. TO 5:30 P.M.
CS-5	44503	YOUTH ACTIVITIES KARATE CLASS	29	6:00 A.M. TO 8:30 P.M.
CS-6	33500	LIBRARY	450	WEEKDAYS - 12:00 P.M. TO 9:00 P.M. WEEKENDS - 1:00 P.M. TO 9:00 P.M.
CS-7	34407	TRAINING BUILDING	28	WEEKDAYS - 7:30 A.M. TO 9:00 P.M.
CS-8	39005	POST EXCHANGE & WEIGHT ROOM	6	6 DAYS A WEEK - 5:00 P.M. TO 9:00 P.M.
CS-9	33417	LIBRARY	7	7:30 A.M. TO 5:30 P.M.
CS-10	40504	THEATER	1000	WEEKDAYS - 6:30 P.M. TO 10:00 P.M. WEEKENDS - 1:00 P.M. TO 10:00 P.M.
D-1	29722	MESS HALL	750	7 DAYS A WEEK - 4:00 A.M. TO 8:00 P.M.
D-2	39105	MESS HALL	240	7 DAYS A WEEK - 4:00 A.M. TO 8:00 P.M.
D-3	39408	MESS HALL	160	7 DAYS A WEEK - 4:00 A.M. TO 8:00 P.M.
FH-2	609	FAMILY HOUSING	4	OPEN 24 HOURS
FH-3	750	FAMILY HOUSING	8	OPEN 24 HOURS
FH-4	1973	FAMILY HOUSING	4	OPEN 24 HOURS
FH-5	2001	FAMILY HOUSING	4	OPEN 24 HOURS
FH-6	1602	FAMILY HOUSING	8	OPEN 24 HOURS
LA-1	39706	SUPPLY	6	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
L-1	2200	LAUNDRY	62	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
MA-1	21805	MAINTENANCE SHOP	20	WEEKDAYS - 6:30 A.M. TO 4:30 P.M.
MA-2	24804	MAINTENANCE SHOP	25	WEEKDAYS - 8:00 A.M. TO 4:00 P.M.
M-1	296	MEDICAL CLINIC	19	WEEKDAYS - 6:30 A.M. TO 3:00 P.M.
M-3	300	HOSPITAL	2700	OPEN 24 HOURS
T-1	18717	TRAINING	44	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
T-2	25601	TRAINING	50	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
T-3	38702	NCO SCHOOL	40	WEEKDAYS - 7:00 A.M. TO 10:00 A.M.
T-4	19724	TRAINING	50	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
T-5	29809	SIGNAL SCHOOL	250	WEEKDAYS - 6:30 A.M. TO 4:00 P.M.

TABLE 3 (CONT'D)
BUILDING OCCUPANCY
FORT GORDON

[illegible]

TABLE 4

Building Group Source Energy Consumption

Group	Description	Group Sq. Ft.	Total Source Consumption Btu's x 10 ⁶
A	Administrative	992,195	272,204
B	Barracks	2,221,279	541,809
CS	Community Service	637,619	260,079
D	Dining	344,864	395,121
FH	Family Housing	1,238,711	259,033
L	Laundry	56,380	25,362
LA	Laboratory	31,247	7,115
M	Medical	726,887	290,077
MA	Maintenance	335,415	46,544
T	Training	1,335,994	431,950
U-1	Sewage Treatment	1,506	2,133
U-2	Water Treatment	10,143	44,887
U-3	Pump Houses	1,400	14,700
U-4	Heating and Cooling Plants	20,474	6,496
W	Warehouses	657,455	63,794
Z	Electric Only		116,145

**ENERGY CONSERVATION PROJECTS
SOURCE ENERGY SAVINGS**

BUILDING TYPE	ENERGY SAVINGS BTUx1,000,000	% BASEWIDE REDUCTION FY'75	PROJECT NUMBER
FAMILY HOUSING	38,701 16,713 38,387 <u>93,801</u>	1.52 .66 <u>1.51</u> 3.69	T-2400 T-160 T-162
BARRACKS	9,218 41,503 17,641 15,810 15,082 10,876 <u>110,130</u>	.36 1.63 .69 .62 .59 .43 4.32	T-2300 T-2500 T-2600 T-161 T-167 T-168
INCINERATOR FACILITY	108,150	4.24	T-166
STEAM PLANTS	6,853	.27	T-165
SELECTIVE ENERGY PLANT	133,000	5.22	
OTHER BUILDINGS AFFECTED BY ECIP'S	13,825 68,327 29,090 20,651 28,451 52,454 <u>212,798</u>	.54 2.68 1.14 .81 1.12 2.06 8.35	T-2300 T-2600 T-160 T-161 T-169 T-168
TOTAL	664,732	26.09	

TABLE 5

ENERGY CONSERVATION PROJECTS DEVELOPED SCHEDULE - FT. GORDON, GEORGIA

PROJECT TITLE	PROJECT NUMBER	RECOMMENDED FISCAL YEAR	COST \$ x 1000	E/C RATIO	ENERGY SAVINGS BTUx1,000,000	YEARS PAYBACK	B/C RATIO
RELAMPING FLUORESCENT FIXTURES	T-2300	1980	287	80.3	23,043	2.5	3.27
STORM WINDOWS, WEATHERSTRIP DOORS AND KITCHEN LIGHTING FIXTURES IN FAMILY HOUSING	T-2400	1980	1041	39.2	38,701	9.1	1.96
INSULATED PANELS, STORM WINDOWS, AND WEATHERSTRIP DOORS IN PERMANENT BARRACKS	T-2500	1980	1176	35.3	41,503	9.4	2.00
INSULATION, WEATHERSTRIPPING, AND STORM WINDOWS IN TEMPORARY BUILDINGS	T-2600	1980	1670	51.5	85,968	4.0	2.17
TOTAL			4174		189,215		
FM RADIO CONTROL SYSTEM	T-160	1981	582	78.8	45,803	2.4	5.33
ADJUST FRESH AIR QUANTITIES	T-161	1981	246	148.3	36,461	1.8	9.95
FAMILY	T-162	1981	851	47.5	38,387	8.9	2.22
STEAM PLANT MODIFICATIONS	T-165	1981	248	27.7	6,853	13.6	1.60
SOLID WASTE BURNING INCINERATOR FACILITY	T-166	1981	3422	31.6	108,150	22.1	1.13
ROOF MOUNTED SOLAR PONDS FOR BARRACKS DOMESTIC HOT WATER (DOE DEMONSTRATION PROJECT)	T-167	1981	1223	12.3	15,082	14.0	1.36
TOTAL			6572		250,736		
UPGRADE MAINTENANCE FACILITIES	T-169	1982	442	64.3	28,451	3.5	5.38
EMCS EXTENSION	T-168	1982	586	108.0	63,330	2.2	5.62
TOTAL			1028		91,781		
SELECTIVE ENERGY PLANT		1983	26570	N/A	133,000	8.4	2.70
TOTAL			26570		133,000		

E/C = TOTAL ANNUAL ENERGY SAVINGS

COST (\$ x 1000)

B/C = TOTAL BENEFITS

TOTAL NON-RECURRING INITIAL CAPITAL COSTS

TABLE 6

TABLE 7

FY81 Average Energy Costs

Electricity	
Demand	\$4.41/kW
kWh (without demand)	\$0.0233/kWh
kWh (including demand)	\$0.0341/kWh
Natural Gas	
Demand	\$6.56/mcf
Commodity (without demand)	\$0.5068/mcf
Commodity (including demand)	\$3.29/mcf
Propane	
Commodity	\$0.603/gal
Fuel Oil	
No. 2	\$1.215/gal
No. 6	\$0.87/gal
Kerosene	\$1.22/gal

TABLE 8

Summary of Increment F Projects

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Cycle Swimming Pool Pump	Building 21608	459	\$ 1,786	.1	225.0	2,716	\$ 169	\$ 75	Electrician 1	31 A178
Disconnect Condensing Unit in Winter	Family Housing (833 units)	2,899	11,277	.2	129.3	1,566	1,851	0	General 140	10 A5
Reduce Hot Water Temperature	Rolling Pin Barracks	663	5,091	.1	206	1,129	587	-	Laborer 27	28 A144
Turn Off Hot Water	Postwide	30,781	168,349	.2	111.8	854	36,053	0	Heat Shop 1,728	14 A44
Outlet and Switch Insulation	Family Housing (833 units)	11,137	46,375	.3	84.0	833	14,192	3,117	General 828	24 A103
Flow Control Shower Heads	52 Barracks	27,222	158,445	.2	118	795	34,384	21,038	Plumber 358	13 A32
Seal Building Wall	Building 19140	197	904	.4	81.6	592	333	50	Carpenter 12 Sheetmetal 48	41 A264
Reduce Hot Water Temperature	Mod Barracks	226	1,735	.2	99.7	546	414	-	Laborer 19	28 A144
Swimming Pool Cover	Building 21608	1,369	6,284	.4	67.2	495	2,766	-	-	22 A80
Insulate Steam Pipe	Building 1301	582	2,670	.6	52.5	381	1,527	487	Insulator 35	43 A286
Insulate Steam Pipe	Building 19120	456	2,093	.6	46.7	339	1,345	404	Insulator 35	43 A286
Reduce Hot Water Temperature	Building 37300	5.3	25	.9	33.5	243	22	-	Laborer 1	28 A144

TABLE 8

Summary of Increment F Projects
(Continued)

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Reduce Hot Water Temperature	Brems Barracks	110	\$ 504	1.1	27.7	202	\$ 544	-	Laborer 25	28 A144
Cold Deck Reset (Surgery)	Building 300	261	948	1.4	15.3	198	1,317	\$ 859	Pipefilter 10	38 A243
Reduce Fluorescent Lighting	Building 300	5,393	19,588	1.4	16.4	192	28,078	10,326	Electrician 225	35 A215
Toilet Tank Inserts	Family Housing (833 units)	725	3,240	1.5	14.6	177	5,123	3,135	General 139	9 A1
Insulate Water Heaters	Building 3730	5.9	27	1.5	19.6	142	42	19	Laborer 1.0	26 A132
Reduce Infiltration in Family Housing	Family Housing (833)	22,974	95,164	2.0	12.6	122	188,646	62,162	Laborer 9330	23 A94
Insulate Water Heaters	Bldgs. 33200, 35202 and 33500	6.1	28	1.9	15.9	115	53	19	Laborer 1.5	26 A132
Cold Deck Reset (O.B.)	Building 300	133	483	2.7	7.8	101	1,317	859	Pipefilter 10	38 A243
Convert Incandescent Lighting to Fluorescent	12 Buildings	4,145	29,082	1.8	10.9	78	53,416	22,226	Electrician 530	32 A184
Boiler Shutdown	Building 35203	4,257	9,700	6.2	7.4	71	60,047	40,764	Pipefitter 650	45 A300
Heat Recovery From Dust Collector	Building 28320	90	415	3.3	9.2	67	1,350	1,029	Sheet Metal 8 Laborer 8	18 A54
Window Insulation	Bldgs. 25713 and 29607	586	2,473	4.3	6.0	55	10,685	4,516	Laborer 359	20 A61

TABLE 8

Summary of Increment F Projects
(Continued)

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Air to Air Heat Recovery (O.B.)	Building 300	467	\$ 2,144	4.9	6.0	44	\$ 10,537	\$7,735	Plumber 8 Sheetmetal 64	42 A270
Solar Film for Signal Tower (West)	Building 29808	155.8	714	6.3	4.7	35	4,516	-	-	11 A9
Solar Film for Signal Tower (East)	Building 29808	148.5	680	6.6	4.5	23	4,516	-	-	11 A9
Air to Air Heat Recovery (Surgery)	Building 300	590	2,706	7.1	4.2	31	19,098	15,261	Plumber 8	42 A270
Window Insulation	Building 200	7.4	34	8.4	3.6	30	285	120	Laborer 10	20 A61
Storm Windows	Building 319	62.3	266	8.1	3.2	29	2,161	1,220	Laborer 40	40 A258
Window Insulation	Building 2401	78	356	8.4	3.6	26	2,991	1,264	Laborer 100	20 A61
Solar Film for Signal Tower (South)	Building 29808	113.4	545	8.3	3.6	25	4,516	-	-	11 A9
Garage Door Weatherstripping	Building 2401	106	486	9.2	3.3	24	4,443	3,374	Laborer 64	37 A235
Reducing Flow Through Flush Valves	Per Unit	.34	1.30	12.0	3.6	22	16.0	5.00	Plumber .5	17 A50
Window Insulating Panels	10 Buildings	978	4,165	11.3	2.3	21	47,094	21,847	Laborer 1385	33 A204
Indoor Pool Lighting Upgrade - Metal Halide	Building 21608	528	7,025	3.5	4.0	21	24,828	11,621	Electrician 192	46 A312

TABLE 8

Summary of Increment F Projects
(Continued)

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Indoor Pool Lighting Upgrade - HPS	Building 21608	638	\$ 9,705	3.8	3.6	17	\$ 36,971	\$19,531	Electrician 192	30 A169
Fluorescent Ballast Replace- ment	Per Unit	0.4	1.5	17	1.2	15	26	18	-	36 A228
Solar Film for Signal Tower (North)	Building 29808	33.9	156	29	1.0	7.5	4,516	-	-	11 A9
Consolidation of Substations	Postwide	-	29,495	7.3	1.2	-	213,902	-	-	47 A326

TABLE 9

Summary of Increment G Projects

Project	Location(s)	Energy	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Narr.	Reference
		Savings/Year MMBtu						Material	Manhours		Pages
Variable Speed Pumping (CW)	Bldg. 25910	29,665	\$ 115,396	.06	37.5	453	\$ 65,487	--	--	15	B99
Boiler Fuel Conservation/ Oxygen Trim Control	Boiler Plants	28,420	143,068	.8	36.0	242	89,030	--	--	22	B167
Automatic Chiller Condenser Tube Cleaning	Bldg. 25910	7,849	36,026	1.1	26.5	192	40,778	\$22,704	Pipefitter 1252 Electrician 9	6	B16
Automatic Chiller Condenser Tube Cleaning	Bldg. 301	4,286	19,673	1.4	21.3	154	27,779	15,466	Pipefitter 400 Electrician 5	6	B1
Variable Speed Pumping (HTW)	Bldg. 25910	7,350	28,592	1.7	12.6	153	48,101	--	--	15	B99
Automatic Chiller Condenser Tube Cleaning	Bldg. 25910	13,650	62,654	1.7	17.6	128	106,950	44,660	Pipefitter 1750 Electrician 13	6	B16
Automatic Chiller Condenser Tube Cleaning	Bldg. 25910	14,333	65,778	1.8	17.0	123	116,130	52,360	Pipefitter 2600 Electrician 18	6	B16
Automatic Chiller Condenser Tube Cleaning	Bldg. 25330	6,416	29,447	1.8	16.8	122	52,685	22,000	Pipefitter 971 Electrician 4	6	B23
Destratifiers	5 Buildings	1,525	7,065	1.8	16.7	119	12,807	8,833	Electrician 110	36	B201
Automatic Chiller Condenser Tube Cleaning	Bldg. 301	4,436	\$ 20,363	2.1	14.5	105	\$ 42,121	\$17,589	Pipefitter 415 Electrician 7	6	B1

TABLE 9
(Continued)

Summary of Increment G Projects

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Ceiling Fans	Building 1301	206	960	2.8	11.0	77	2,675	704	Electrician 44	11 B75
Automatic Chiller Condenser Tube Cleaning	Bldg. 301	1,829	8,396	3.5	8.4	62	29,487	12,313	Pipefitter 815 Electrician 12	6 B1
Fluorescent Lighting Load Reduction	Postwide	23,034	206,560	2.1	10.1	55	422,047	194,692	Electrician 3,384	10 B51
EMCS Extension	6 Buildings	59,002	402,664	5.4	4.4	27	2,170,000	--	--	17 B120
Heat Recovery From Mid-Sized Boilers	Postwide	328	1,506	9.4	3.2	23	14,112	--	--	14 B87
Solid Waste Incinerator Plant	Adjacent to 25330	59,607	160,160	23.4	1.1	14.6	4,087,000	--	--	21 B145
High Temperature Water Line Repair and Insulate	Distribution for Plant 25910	43,855	336,806	10.0	2.7	13.0	3,362,000	148,117	Pipefitter 51,000 Laborer 34,000	20 B134
Infrared Heating	28 Buildings	5,482	25,164	20.5	1.4	10.6	516,675	197,976	Electrician 5,845	9 B38
Burning of Waste Oil	Building 25910	499	2,533	22.1	1.9	8.9	56,074	--	--	16 B113

TABLE 9
(Continued)

Summary of Increment G Projects

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Power Factor Improvement	Substation	--	2,051	4.0	5.3	--	8,272	6,052	Electrician 53	18 B127
Power Factor Improvement	Hospital	--	\$ 2,051	23.3	.9	--	\$47,727	\$15,792	Electrician 476	34 B189

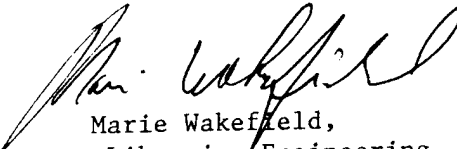


DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.


Marie Wakefield,
Librarian Engineering